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Again, the Arachnida are placed in a division with "pediform Gnathites," but in what respect are the mandibles and maxillæ of spiders and mites any more pediform than those of insects and Myriopods? And in the sucking Myriopods we have an entire family with mouth parts not much higher in grade than those of the Tardigrades and Pentastomida.

The author shows a tendency to coin terms for parts already named, thus *gonapophysis* is used instead of Lacaze Duthier's elegant term *rhabdite* for the blades of the ovipositor. The term *Echinopædium* is used for the larva of Echinoderms, which exactly corresponds to Packard's *Cephalula*, proposed in this journal (May, 1875, p. 283, and Life Histories, p. 94) and extended to embrace a similar phase in molluscs and worms, as well as Echinoderms. But these are the merest blemishes in a work quite indispensable to students, and the production of one whose general accuracy of statement is universally recognized.

HUNT'S CHEMICAL AND GEOLOGICAL ESSAYS.<sup>1</sup> — No changes appear to have been made in the text beyond the correction of typographical errors, but in the preface to the second edition, Prof. Hunt takes the opportunity to farther notice the question of the temperature of the earth's surface in former geological periods. He concludes that a reduction in the weight of the atmosphere in early geological times, by causes to which he alludes, must have produced a considerable refrigeration of climate, and a still greater cooling of the globe by the diminution of the proportion of carbonic dioxyd contained in the atmosphere. He concludes as follows: "Geographic changes, though a true cause of local variations of climate, and adequate to explain the greater refrigeration of certain areas since the commencement of the pliocene, are not sufficient to account for the warmer climates of previous ages, and we conclude that the cause of these is to be found in the former greater volume and different chemical constitution of the atmosphere, as already set forth.

"This view is opposed to the hypothesis maintained by many geologists of an alternation of warm and glacial climates at the surface of the earth, repeated from the earlier times. Dawson and Heer, however, from the study of the fossil floras found in arctic regions, from the devonian to the miocene, conclude that palæontology affords no evidence of such a condition of things, and the observations of McCoy, Hector and Hutton in the southern hemisphere lead them to similar conclusions. The nurseries of these successive northern floras appears to have been in the arctic regions, and their spread southward would, according to Dawson, be due to continental elevations, bringing about, at irregular periods, a cooler climate in the northern temperate zone.

<sup>1</sup> *Chemical and Geological Essays*. By THOMAS STERRY HUNT, LL.D., etc. Second edition. Revised, with additions. Salem, S. E. Cassino, Naturalist's Agency. 1878. 12mo, pp. 489.

It may even be conceived, as well remarked by J. F. Campbell, that such elevations might bring large areas of the earth's surface into the region of perpetual frost, thus giving rise to local glacial phenomena, while a warmer climate prevailed everywhere at the sea level. Nordenskiöld declares that he sought in vain for evidences of ice action in the various sedimentary deposits in Spitzbergen.

"In regard to a suggested explanation of former climatic conditions, the author may be permitted to quote the following language used by him in 1876: 'Recent speculations have revived the old notion of a possible change of the earth's axis of rotation as a way of explaining this change of arctic climate; but such a phenomenon is astronomically improbable, and is also opposed by the fact that the direction of the oceanic currents, which are guided by the earth's rotation, appears, from the distribution of marine sediments to have been the same since very early periods.' Dawson has since urged the same argument, and reinforced it by recalling the fact that the southward migrations of successive floras, not less than the lines of distribution of mechanical sediments in past ages, show that from early paleozoic time the general courses of the oceanic currents, and consequently the position of the earth's axis have not changed."

It seems to us that this is the soundest and best exposition of the question of pre-quaternary glacial climates that we have met with.

The Taconic rocks are further discussed, and the name Taconian suggested for the lower Taconic series. These Taconian rocks are regarded by the author as corresponding to "four great series of pre-Cambrian rocks, and mark as many successive periods in eozoic time." With a reference to recent views on the origin of crystalline rocks, and a re-affirmation of the neptunian views of the author, the preface closes.

**BOTANICAL DIRECTORY.**—The Botanical Directory for America for 1878, will be found exceedingly convenient. Part I gives the names of botanists and their state, while their full addresses will be found in Part II, where the names are arranged by states. The price of this useful directory is forty cents, three copies for one dollar. The list is a large one, and it is only to be desired that a larger portion of those whose names appear were so situated as to be able to be actively engaged as investigators.

**WATSON'S INDEX TO NORTH AMERICAN BOTANY.**<sup>1</sup>—This is a compact volume compiled and printed with great evident care, and is a laborious and useful work. It is intended to facilitate

<sup>1</sup> *Bibliographical Index to North American Botany; or Citations of Authorities for all the recorded indigenous and naturalized species of the Flora of North America, with a Chronological Arrangement of the Synonymy.* By SERENO WATSON. Part I. Polypetalæ. Smithsonian Miscellaneous Collections. 258. Washington, March, 1878. 8vo, pp. 476.